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From co-ordination to loyalty

Developing a constructivist perspective on organizational and technological changes

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I. Introduction

The objective of this article is to present an overview of analytic techniques which CITA² applies to organizational change in regard to the development of information systems³.

We deploy a sociological analysis on the basis of these three fundamental concepts (organization, information system, change). We propose a 3-dimensional way of thinking of this, based on theory and methods taken from the literature on organizations, especially the organized action political theory (developed by Crozier and Friedberg (1963, 1977, 1993)) and the theory of the « Economie de la grandeur » («Economics of Worth») as presented in Boltanski and Thevenot (1991). In our model of change in organizations and in technology, political analysis holds an important place. The theories and methods we have studied in fact already contain the concepts of agents, goals and stakes, power relationships, areas of uncertainties, resources, and strategies.

The first part of this article will present the conceptual framework of our approach to the question : what organizational changes are inherent in the development of new information systems ? In the second part, we will put the framework into operation, presenting the results of analysis and observation of technological and organizational change experienced by three Belgian emergency response services. We closely observed the process through which technological and organizational changes were decided on and carried out in regard to the development of a new information system. Our procedure compares what was observed with other intervention methods, and particularly with the Requirements Engineering. The result raises a question regarding the role which social sciences should play in the design of information systems.

Our field observation work presupposes some familiarity with the milieu into which a new information system is introduced, and some ability to analyze along with the actors or agents in the given situation the way they currently do things, the norms which govern their working together, and which issue in their ideas about the way things will go with the new

² CITA (Cellule Interfacultaire de Technology Assessment Cell) is a interdisciplinary research center specializing in technology assessment, in the sense of a social evaluation of technologies. Created in 1988 by four departments at the University of Namur, ITAC focuses on information technology and communications technology. There are five principal research specializations : technology assessment, the social construction of technology's uses, organizational analysis, the politics of technology, and the ethics of information systems.
(<http://www.info.fundp.ac.be/~cita>)

³ In this article, when we speak of information systems, we mean the computer technology used in these systems

system. In this process of conceptualizing, we have in fact a succession of representations (Landry, Pascot and Radijanovic, 1989). This work of representing has two sides : «...one in the sense of the representation of a theater, and one in the sense of a diplomatic representation...» The one doing the imagining or conceiving must in effect construct representations, which, says Ladriere (1968), «...present to the spectator, in concrete form, a meaningful situation, meaningful personages, sequences of exemplary actions...» And for Landry, Pascot and Radijanovic (1989, p. 14), « The one who imagines or conceives of something...also has to construct a diplomatic representation... because of his or her position as an intermediary between management and the information experts». This article will examine the work involved in constructing this representation, and in operating in such a diplomatic or interpersonal situation.

II. A constructivist perspective

Epistemologically, our conceptual framework is constructivist. We consider organizations and information systems as social constructs, at one and the same time processes and products of negotiations and conflicts between actors whose rationality is at times limited or contingent.

Perhaps one cannot speak of various schools as being in agreement as concerns constructivist theory of organizations, but one can speak of «a common space within which certain shared characteristics appear» (Rouleau, 2001), and not the least an inclination to take the history and thought processes of actors in given situations into account.

In other words, «From a constructivist perspective, social realities are taken to be the historical, daily constructions of individual and collective actors» (Corcuff, 1995, p. 17). The term construction suggests the activity of building, and materials to be used, and a final result. This perspective thus considers social realities as the products of interactions, a historicized viewpoint. Historicity is a major notion in constructivism, implying anticipations of the future as much as influences of the past on the present. Taking this temporal perspective is what allows us to trace the production and permanent reproduction of social realities in interactions between persons (Mehan, 1982).

The social realities so defined are at one and the same time constructed by these actors and limited in and through their interactions : «Action, as historical action, takes stock of itself and objectivates itself in an exteriority which weighs upon the existent, an unavoidable constraint which nonetheless leaves open a real future.» (Ladriere and Van Parijs, 1984, p. 200). Social realities can be considered as both objective and subjective at once. They are objective: past constructions, future anticipations weighing in as limits or constraints on today's interactions. They are subjective inasmuch as they are individually interiorized, as representations, in the form of knowledge, things intended or aimed at, etc. In these terms the constructivist perspective we have chosen in order to attack the question of organizational change inherent in the introduction of new information systems is in fact a dialectical perspective (Ramognino, 1982).

From such a perspective, we attach as much importance to what authors like Berger & Luckman (1979) have called the institutionalization and legitimation of social realities (which takes account of the manner in which social realities are progressively objectified and stabilized), as to the processes of social construction themselves. We thus avoid the trap which absolute relativism represents. «Saying that a house has been constructed simply means it is the result of human labor, and has not existed forever (...). Versions of constructivism are thus new forms of realism, which are nevertheless different than classical forms of positivism, because they question 'givenness' and leave open a place for plural realities, whose mutual relations must be thought through.» (Corcuff, 1995, p. 19).

III. From co-ordination to loyalty : the conceptual framework

In our model, the organization is the context - the backdrop, already there, against which actors imagine or conceive their choices in the area of technological development, working through repetitive sequences of goal-setting, implementation, evaluation and modification, sequences which Van De Ven and Poole (1995) call «teleological change». But the organization as backdrop is not only a context. It is also something in play (as we shall see in the work of Orlikowski and Barley (2001)), since choices of an information system do not

occur without some effect on the 'standard procedures' which characterize the existing organization. To begin our presentation of the conceptual framework, we present now the idea of the organization which underlies our research.

Following Friedberg (1993), we take organizations to be social constructions. «Such social constructions are always at one and the same time productions and reproductions of a certain order of things. They are based on pre-existing data relative to a context which they at the same time transform.» (Friedberg, 1993, p. 25).

Studying organizations as contexts and as constructs requires three analytical dimensions to be followed up : the level of structures in which actors' games are played out, the level of relations between actors who set these structures in motion, their games contributing to the development of these structures in the sense of new organizational conditions, and the level of meaning, that is, principles of legitimacy through which actors justify their games and the orders of things which are thus constructed.

These three levels appear to us to be inseparable within the analysis. They enable us to cut away from a too voluntaristic view of the organization and its changes, a view which holds that changes are after all 'the business of actors' (Courpasson, 1968, p. 7). By giving a large place within the analysis to the study of contexts or the already-there of structures, we do not cease to consider the actor important, but find him or her rather constrained in action, in the room he or she has to maneuver, and by existing structure and by the meaning which the actor manages to give to it. It is important to note that this constraint on action is recognized in the work of Crozier and Friedberg (1977), but sometimes underestimated within analysis by the omnipresence of the autonomy of the actor.

Existing structure is thus our first point of entry into the conceptual framework which underlies our researches. Our approach to existing structure is strongly tied to our object of study, that is, information systems. Following the work of March and Simon(1958), Thompson (1967) and Galbraith (1973), we treat existing structure as a set of means placed in operation by human beings in order to go beyond the limits of their minds alone as regards handling quantities of information. This view on organizational structure as a matter of information-handling tends to place that structure on the same footing as information systems themselves, that is, as means, as artifacts, as products of human action whose purpose is to reduce uncertainties associated with the role of information in organized action.

From a purely mechanical point of view, structure belongs to two complementary orders of things, one which differentiates and one which integrates, starting from which actors construct functional equilibria. The differentiation of tasks belongs to the principles of division of labor ; these principles tend to simplify flows of information, and to separate them into specialized roles in order to bring them within the handling capacity of limited human thinking. Integration has to do with the interdependence, in terms of information, of these specialized roles, which allows the whole to function in general terms. Differentiation and integration both belong to a principle of *co-ordination*, and this principle is the touchstone of all organized action. In a mechanical-logical representation, organizational dysfunction is seen as the result of faulty differentiation or integration, which leads to a break in the equilibrium between these terms.

The mode of thinking which dominates at this mechanical level is that of economic calculation of the means of coordination which have been set in motion in order to manage the interdependent aspects of the flow of tasks. Such means must be effective as regards outer-directed action which responds to environmental constraints, and equally efficient as regards inner-directed action aimed at reducing the burden of managing the interdependent aspects of the flow of work.

While the constructed character of existing structure is not missing from this mechanical view, two limits must nonetheless be underlined. The first has to do with the singleness of the thinking process at work in these constructions. This point echoes one of the critiques formulated by Giddens (1979, 1984), applied to the type of approach whose functional explanations neglect the competence and intentional activity of actors, and which prefers to locate a self-sufficient logic and rationality within the social system itself. As we shall presently see, other types of rationality come into play in the production and reproduction of these structures, types of rationality which go beyond simple economic calculations.

At any rate, this dimension of the analysis tells us nothing of the humans who operate the structures, producing and reproducing them through their actions. Giving priority to structuring over the structured, this approach leads to the illusion, that «structures are endowed with some miraculous power which allows them to operate all by themselves» (Chazel, Favereau, and Friedberg , 1994, p. 88).

Therefore it is important to grasp these structural constructions as operated by multiple rationalities, since the constructions are both constraints which limit actors' capacity for action, and things which are involved and at issue in any possible cooperation between

actors, whose interests cannot be reduced to those of the organization. From a mechanical approach which makes *co-ordination* the touchstone of all organizational structure, our model moves to a political dimension which asks about the way in which actors grasp existing structure, operate with it, and transform it in the course of negotiations over their *cooperation*.

In « Le pouvoir et la règle » (Power and Rules), Friedberg (1993) takes us from an idea of organizations as unified and coherent entities at the service of a single rationality, to a complex notion of construction of games. It is this notion of the organization as a human construct which we put first in the more political aspect of our model. Following Friedberg (1993), we believe that organizations are constructed through the interactions of their members. "The phenomenon of the organization thus appears as the contingent and always provisional result of the construction of a local form of order whose relatively autonomous characteristics structure the capacity for collective action which the persons who are involved in the organization possess. « (Friedberg, 1993, p. 21)

The importance of this definition is that it takes into consideration the fact that the phenomenon of the organization is both constraint upon human action and its result. Friedberg's position allows us to remember «the constructed and thus precarious nature of order within organizations» (1993, p. 24). This position makes it possible for us to seek out, behind the apparently well-ordered aspect of action, problems due to conflicts of different rationalities and different interests, problems of mutual support and alliances, and the processes which form the framework of collective action, processes of authority, negotiation, and progressive structuration.

Our use of the notion of organization developed by Friedberg also allows us to insist on the fact that forms of local order are the partial, provisional, and contingent results of a social construction. «This social construction is always production and reproduction of a certain order at the same time: it is based on pre-existing data related to a context which it also transforms at the same time.» (1993, p. 25) Therefore its existence and its maintenance through time cannot be taken for granted.

And organizations, therefore, are made up of groups of actors who are placed in a context of strategic interdependence. The ultimate goal of reflection on organizations in general in this respect is to study the processes through which conflictual cooperation is structured. For Friedberg, «... 'collective constructs' cannot be grasped except by a conception of the interdependence of actions within concrete interaction, as processes which are 'in the process of being accomplished» (Chazel, Favereau, and Friedberg, 1994, p. 88).

Friedberg (1993) makes empirical observations concerning the freedom of action of actors, that is, their capacity to determine their own conduct as a function of consideration of opportunities, all within a more or less wide or narrow range of possible conduct. Still, the range of actions of particular actors is «structured on one hand by their belonging to cultures» (national, professional, organizational cultures), and on another hand by «social and material conditions which prevail» and which «are supported by groups of structures and overarching rules» (Friedberg, 1993, p. 26).

These things restrict the range of choices available to actors, but their behavior is not reduced to that range. It is rather the product of a kind of personal tinkering to find solutions, which combines elements drawn from these overarching structures, and the consideration of strategic opportunities which are the result of interactions and processes of exchange in which actors are locally involved. Even if the results of such tinkering get integrated into routines, they remain quite precarious.

In these terms, then, a local order is the product and the fitting-together of the result of tinkering, and this result is not reducible to a part of the overarching structure. The end result of actors' jury-rigging of things is a relatively autonomous political construct which regulates conflict between various actors at its own level, and which maintains the fitting-together of their respective interests and goals as well as that of collective interests and goals (Friedberg, 1993, p. 26).

This political approach may allow us to grasp the organization as a social construct, at one and the same time a constraint and a goal as regards relations of cooperation which hold between actors. But it is important to point out the limits of this approach.

The first limit is a political one, linked to the use of this theoretical framework in change-related behavior. As Courpasson emphasizes, from this perspective «change is not imposed from on high by a natural law or by well or ill-intentioned authorities; it is analyzed as being contingent, localized, even subject to a sort of co-construction, in the interest of the organization and its members» (Courpasson 1998, p. 8). Thus this perspective privileges the idea of constructed change, always the product of some negotiation, the product of local arrangements between actors, and thus also a product of consensus. This quite consensual perspective of change draws a kind of veil over the oppositions and conflicts which it might give rise to. So, following Courpasson, it appears to us that «consensus about the importance of change appears thus to come from a form of liberalism, that of popular consent, the democratic expression of the will of the majority, always coming about through negotiation;

and so sociology will turn away from actual inequalities of resources in favor of actions leading to changes (in the relations between) the members and the leaders of the organization... Only a mention of 'resistance' to change will be added to modify that point» (1988, p. 7). This political limit seems important to us, even if the scope of the analysis is not altered.

A second limit of political analysis is related to a very liberal conception of resources as manipulated by actors, and of actors' interests. This conception contributes to our seeing organizations as constructed through the negotiations of actors whose only levers of power are the uncertainties which they have mastered, and whose only motives involve their individual or collective interests. Everything happens as if the only principle of legitimacy for the games which actors pursue was (in the terms of Boltanski and Thevenot, 1991) that of the world of the marketplace, a mercantile principle. It seems, though, to us that other types of legitimacy can be operating within these games which spring up within an organization, and that some consideration of the symbolic dimension of action will allow us to give a less mercantile and more complex picture of actors and their actions within an organization.

We come to the last element of our conceptual framework, now taking into account its symbolic dimension. Here we enter the realm of representations, and beliefs which influence actors and their actions. More particularly, we have thought it advantageous to add to our conception of the organization an approach involving different forms or types of legitimacy which actors take advantage of in justifying their behaviors and strategies. Such systems of legitimacy have been defined by Boltanski and Thevenot (1991) as so many ways of thinking about that which is "the greater", visions which have been unfolded through history in connection with the many meanings given to the idea of public interest or the common good in political philosophy.

This use of the symbolic level allows us to analyze not only actors' strategies, but also the norms and principles which govern their behavior, such as these are created in systems of symbolic representation or systems of perceptions of the meaning of organized action, with its individual and collective aims. Therefore the motives of negotiations which underlie organizational constructs cannot be interpreted as reflecting only individual or collective interests, but depend equally on mutual agreements which are implicit under particular forms of legitimacy, which give meaning to action within an organizational context. We pass here from a political analysis of cooperation as negotiated between actors, to the level of adherence or *loyalty* to systems of legitimacy to which actors refer in justifying their actions,

or in giving meaning to their rationalities. The bonds of agreements which are formed within an organization can no longer be interpreted as the always provisional result of an actor negotiating his participation within a group, but represent something more permanent which gives meaning to collective action over and above particular interests. And so on the symbolic level the spatio-temporal location of our analyses is displaced. The local and the provisional may have dominated the scene of the analysis of the cooperation between actors, but the symbolic level requires us to admit a more permanent and more collective status for the various types of legitimacy which actors invoke to justify their actions within an organizational context.

So we have now determined the first concept of our model, namely, organization seen under three aspects : mechanical, political, and symbolic. This definition of the concept of organization in turn affects the definition of the object we shall study, that is, information systems. And we will also have to take account of the interrelationships between these three dimensions.

In our model, then, information systems are seen as human artifacts which must be given a 'thick interpretation'.

From the mechanical point of view, information systems can be viewed as a grouping of hardware and software which humans create in order to go beyond the ordinary limits of their individual minds, as concerns the processing and coordination of information.

From a political point of view, information systems must be viewed as objects of contention, to the extent that their development is not neutral with regard to actors' interests, or the fragile agreements on which their ability to cooperate depends.

From a symbolic point of view, finally, information systems are meanings which get incorporated in the process of development of various kinds of equipment, hardware and software, all this happening through different types of legitimacy which guide the systems' orientation, types of legitimacy which are involved in actors' choices.

We still have to address the question of the relationship between information systems and organizations. We will do this in the paragraphs which follow by continuing to set forth our major question, concerning the process of organizational change as this is linked to information systems' development. We will base our account here on the constructivist perspective developed on this point by Orlikowski (1992).

While the bulk of research concerning the development of technologies within organizations has been strongly influenced by the contingency-theory school, the work of Orlikowski (1992) departs from the determinist view of technologies in organizational structures. The perspective of the contingency school ignores the role of human action in the construction or use of technology, turning rather toward the social impact of new technologies (Rouleau, 2001. p. 8). Conducting research from a constructivist viewpoint, Orlikowski (1992) offers a theoretical model which allows information systems to be thought of in different ways, through integrating their objective reality and their subjective reality, which involves the perception of information systems and the meaning given to them by the actors who make up the organizations (Rouleau, 2001, p. 8). According to Gioia and. al., though it is usual for the impact of a decision in favor of change upon the results of an organization to be well documented, the processes implied in the understanding, the acceptance, and the institutionalization of a new organizational reality during periods of transition have not been adequately studied. That question, precisely, is at the heart of our analyses.

It is in fact important to ask questions about the dynamic of the process of change. In an article which has proved influential, Van De Ven and Poole (1995) provided a synthesis of theories which had to do with processes of change within organizations. Among the various ideal-types presented by the authors, the one they identify as “teleological theory” is closest to our vision of change. We see processes of change as repetitive sequences of goal-formulation, followed by implementation, evaluation, and modification based on what may have been learned or thought by the entity, that is, the organization, the group, or the individual involved with change.

This processual conception of change corresponds to our definition of an organization, taking account of both the historicity of the phenomenon and the capacity for reflection (thought) of the actors. In this way “teleological change” allows creativity and the diversity of individual thought processes, to be expressed. There is no permanent equilibrium, but there are local areas of order whose dynamic of construction has to be understood. But while teleology insists on the reflexivity of the actor seen as an agent of change, it also recognizes limits affecting that agency. According to the authors who defend this notion of change, the environment and the resources of the organization are limits of such processes : « Individuals do not override natural laws or environmental constraints, but they make use of such laws or constraints to accomplish their purposes » (Van De Ven et Poole, 1995, p.

516). This definition of organizational change thus fits in with the constructivist perspective previously presented. It places the accent on the processual dimension, that is, on the political and symbolic games played out live by actors, and also on the importance of contexts, both as constraints on action and as the result of action. It is at the heart of the dynamic of the relation between organization and system, grasped through the idea that «context is not just a stimulus environment but a nested arrangement of structures and processes where the subjective interpretations of actors perceiving, comprehending, learning and remembering help shape process» (Pettigrew, 1990). This conception comes in the wake of other writings (Giddens, 1979) which held context to be not only a constraint on action but a factor in its production.

Now that we have defined our conceptual framework and specified the lines of our research question, we begin to enter into our investigation proper.

IV. Categories of analysis and methods of investigation : a few propositions

We may indeed take an interest in information systems from a constructivist point of view (such as we have just discussed), but we must be sure not to limit that interest to the simply instrumental dimension, so that we will remain able to take account of what Madeleine Akrich calls « (...) their thickness, that is, that which makes them mediators and not simple instruments» (1993, p. 91).

In this section, then, we shall begin our exposition regarding the investigative procedures developed in our research center for the study of the processes of development of information systems in organizations. We shall illustrate our observations by drawing on field work done in the framework of ARTHUR⁴ (Architecture de Télécommunications Hospitalières pour les services d'Urgences), specifically in connection with a project in which a prototype information system for three Belgian emergency response services was developed⁵.

⁴ This is an inter-university project (UCL, FPTMS, ULg, FUNDP) financed by the Walloon Region, set to last for three years starting in October 2000.

⁵ This article deals principally with methodological aspects developed in the course of the project. The results will be published elsewhere.

The object of ARTHUR is to design an innovative system for the acquisition and display of data in an environment which can be chaotic, fluid, tense, and crisscrossed with people doing different things, and further to test and perfect the system's specifications and elements through installation of a trial system in an actual emergency response unit. The system requirements and particular applications must allow patients to be tracked continuously from first contact to the time they are discharged, and also allow data to be shared among several responders who may be miles from the scene, yet who are in consultation regarding the treatment of the same patient.

The construction of this prototype was carried out by an interdisciplinary team, which was set up in a hospital, but remained in communication with other research programs situated in university labs, with an eye toward the eventual integration of technological innovations in the trial system. In service testing is planned throughout the project.

Our research team had particular charge of two types of activities within the project. The first concerns analysis and evaluation of existing organizational structure ; the second, observing the setting up of the actual system on site. Here we will only discuss the first task, in order to set forth the methodology employed in investigating.

This project's objectives depend on more or less voluntary participation by hospital-based emergency response units, as afforded by the directors of these institutions. This partnership is linked undoubtedly to interests which the hospitals had at the time when their participation was solicited, in the start-up phase of the project. The directors were interested in the development of very flexible information systems which would multiply the effectiveness of current personnel. They were willing to try to sell their employees on such a system, since they were the ones who would be using it on a daily basis.

Individual researchers in turn have particular research aims, which tend to go together with the research centers they belong to. Researchers analyzing organizations, who also take part in the development of information systems, do not necessarily share all the particular concerns which the developers of this actual system have : « As in engineering, the practical question 'what works ?' drives much of IT research. (...). As do other social scientists, students of organizations seek primarily to answer the question 'why ?' » (Orlikowski and Barley, 2001). Over and above the primary object of the project, there is considerable variation in actual research focus as regards individual interests, and it is hardly impossible that this should have had an effect on the way different team members perceived the object of the research project.

However, the aims of researchers differ from those of administrators of the organizations studied in respect of the researchers' interest in conceptualizing the situation, an interest which goes beyond instrumental responses to needs, and beyond the expectations of participating organizations.

In the area which concerns us, that of the analysis of organizations such as we have defined them, what is at stake for a research team such as ours involves the ability to construct a 'social knowledge', which can enable us to take account of observational data and actions by persons involved in the activity which is being studied - in this case, the development of an information system. The construction of this social knowledge involves the dialectic of representation which was mentioned above in connection with the passage cited from Ladriere (1968), in our introduction, in which we see that it is not only a matter of representing the situation (in the sense of a theatrical representation) through social knowledge which makes sense for the various actors, but also, in the diplomatic sense, a matter of our serving as intermediaries between various actors.

Working from this perspective, we take this opportunity to specify our investigation's methods, and to set forth our categories of analysis, in order to show in what respect these procedures shed specific light and have specific pertinence for the problematic which concerns us.

In overall terms, we chose to have our empirical studies follow the principles of qualitative research based on case studies as defined by R. Yin : «A case study is an empirical inquiry which examines a contemporary phenomenon within its actual context, where the boundaries between phenomenon and context are not clear and evident, and for which multiple data sources are utilized» (1990, p. 17). We chose this procedure because it places emphasis on the dynamics at work in this particular context, and does so from a comprehensive and fully contextualized perspective. This move is justified first and foremost by the complexity of our research problematic, whose objective «...is to grasp the subjective and intersubjective meaning of a concrete human activity, beginning with the perceptions and actions of various actors on the scene» (Hlady Rispal, 2002, p. 62).

The selection of cases or "organizational phenomena" to be analyzed is negotiated with the actors on the scene at the outset of the project, on the basis of criteria which are essentially theoretical. Far from seeking some sort of statistically representative character for our "sample", we paid close attention to the contrasts between different sites studied, in

terms of environment, size, arrangement, and the sources of community support or funding, which vary from sector to sector.

For the ARTHUR research, we chose to partner up with three hospital-based emergency response services which were essentially differentiated according to the public or private nature of the institution (the hospital), the number of staff persons employed, the number and type of patients treated daily, the status of personnel, and the geographic localization (urban or rural).

Once the negotiations with hospital authorities regarding access to the work areas were concluded, we carried out preliminary interviews with those in charge of the particular emergency services, and we closely examined their internal documents in order to become familiar with the context in which services were provided, and in which the decision to develop an information system had arisen.

Next, we constructed a matrix of observational categories focusing on the handling of data and information by the emergency response teams. After testing and modifying this matrix, we proceeded to two periods of observation at each site. These periods lasted three days and two nights, and were primarily intended to allow us to become familiar with the ways in which the response teams carried out their tasks, taking account of the diversity and complexity of these tasks. The researchers were thus inserted into various groups at work, and noted all relevant actions and interactions. This data was completed by interviews with workers representing different personnel categories making up the emergency service. These interviews were conducted in accordance with guidelines for semi-structured interviews, and lasted about an hour. About ten interviews per site were conducted. At the same time, specific documents having to do with the handling and exchange of information in and around the emergency services were identified and analyzed.

It should be noted that this type of procedure presupposes a high degree of interaction between the research team and the 'field' of investigation. From an epistemological point of view, such interaction tends to raise the question of the separation or distance between the researcher and his or her object of study (Popper, 1959). The relation to the object is quite unusual in this case, since observation prior to the conception of an emergency service places the researcher in the position of acting upon the reality he or she is seeking to grasp, and since the reality acts in turn upon the dynamic of the research.

Overall, our investigative methods have been articulated around three dimensions as presented already, that is, mechanical, political, and symbolic.

The first of these dimensions has to do with the identification of the contexts of unities of analysis. The organizations to be investigated have been identified, and so it is appropriate before anything else to determine the “boundaries” of the units to be analyzed ; these units are to be understood as local areas of order whose definitions are not necessarily provided by the “boundaries” of the organization proper. The sociological analysis of an emergency response service cannot be summed up at a glance, in relation to a given service or hospital emergency room, but must on the contrary be able to be read as a series of organizational layers which is quite complex, being made up of numerous constructs which place different actors on different stages, both inside and outside the hospital. The categories we settled on in order to analyze the various unities were categories of actors, material equipment, internal context, and external context.

Identifying these unities of analysis presupposes that we take into account the environmental characteristics of the various organizational systems involved in the project. To do this, we set up two distinct levels of analysis in order to account separately for the external and internal elements of the particular unit under investigation.

From an external point of view, we established types of requests for goods or services to which the organization had to respond appropriately. In order to do this, we used indicators which belong to the contingent approach to organizations, which allow the predictability, the stability, and the complexity of demand for services to be specified. In the same way, we took note of competing or alternative possibilities in order to determine the more or less threatening nature of the external context with regard to a particular unit being analyzed.

Once these critical elements were determined, we sought to specify the objectives of the organizational group being studied, which we specified with reference to the concepts of H. Mintzberg concerning goals related to missions, and goals of systems. The first set of concepts refers to products, services, or clients of the organization, while the second set has to do with the organization itself or its members, independently of the goods or services it produces (Nizet and Pichault, 1995, p. 99-100).

In the course of doing all this, we also identified the principal mechanisms of the organization of work which were in operation, in this case mechanisms of differentiation and integration. Differentiation is the «process through which individuals do not all do the same thing, but attempt rather to perform with constantly increasing skill the well-defined tasks they have within a larger overall task» (Zan and Ferrante, 1996, p.40). We have sought also to

identify operative principles of the division of tasks, specializations, and the system of roles, and we attempted to determine the organigram of the organizational unity analyzed. In the same manner, we paid quite close attention to mechanisms of integration, as in this definition : «..the process through which the separate efforts furnished by each one according to his or her role are directed toward the goal originally intended (for the whole)» (Zan and Ferrante, 1996, p.45). Such mechanisms can be of many kinds, involving existing hierarchies, norms and procedures, values...

At the end of that stage, we were able to proceed to an initial organizational diagnosis, essentially mechanical, of the structure and dynamic of the organizational unit under consideration. That also led us to the identification of certain functional problems linked to the handling of information, and the management of interdependent relationships between various emergency response actors, having to do with information. The initial diagnosis also allowed us to determine some of the characteristics and specifications of the information system which would be constructed ; it was centered on the problematic of coordination, and was the result of the mechanical dimension of our models.

The initial diagnosis was able to illuminate the extent of the field of possibilities as regards the development of an information system, but it is important to compare the field of possibilities which was drawn up on the basis of the mechanical dimension alone, with that afforded by the other dimensions, beginning with the dimension of actors acting within the organizational unit under consideration.

The whole group of elements brought forward at the end of our first investigatory stage can be considered as limits on the range of choices of actors on the scene, relative to the attitudes adopted within the context of change, that is, the introduction of a new information system. However, there remains a zone of imprecision within which each actor evaluates what is at stake, so as to be able to opt for one or another line of behavior. This calculation is largely implicit, even unconscious, as it is being carried out by the particular persons involved.

In this way of looking at things, power is inherent in the organizational phenomenon, in that it (power) only exists to the extent that actors on the scene are bound by constraints of the group, that is, constraints due to an organized group which is organized in order to accomplish goals related to the organization's mission, and goals related to the system, as these relate to the organizational unity under study. The actors' power comes from what

Crozier and Friedberg (1977) call a “zone of uncertainty” with regard to whether or not the given actor will be able to act as he or she wishes, faced with other actors. This uncertainty confers power to the extent that the actor’s action is not predictable. But this uncertainty must bear pertinently on the other actors involved in the relationship ; it must affect them in some way as they pursue their specific objectives.

Power is indissolubly linked to the organizational phenomenon, and vice versa. Actors on the scene cannot attain their collective objectives, except through exercising power relationships, but in turn they cannot exercise power over others except insofar as this comes in the pursuit of the collective aims which determine for the most part the terms of their negotiations. After that, it is the organization which defines, as we might say, the pertinence of the zones of uncertainty which actors control, and which determines their power resources.

An actor, whether individual or collective, is an intelligent subject (reflexivity) endowed, we said, with contingent and limited rationality (Friedberg, 1993). Identifying an actor comes through empirical observation of daily modes of functioning, and this identification cannot be made a priori or in abstracto. «Speaking about the strategic actor means (...) that all the individuals in a field are constantly forming hypotheses about their fellows, concerning their identities, their interests, their desires, their projects, and consequently they also unceasingly interpret the indications furnished to them by the behavior of others, that they may respond in turn, knowing that the others are doing the same thing, and that the others know they are doing this, and they know the others know this. Thus we are presented with an active being who does not passively absorb the context surrounding him or her, but structures it himself or herself in turn, an active being who by adapting himself or herself to the rules of the game in his or her context of action, modifies those rules through his or her action » (Friedberg, 1993, p. 198). According to this author, such an actor can be described as empirical, human, and calculating.⁶

⁶ Empirical, for the actor is defined only by his or her belonging to a context of action which he or she contributes to by structuring it, and this as a function of his or her capacities for intervention ; human, because the non-human does not exist as an in-itself, «outside of and independently of the perception of actors who alone can actualize (the non-human) in and through their behavior »; calculating, a notion which extends and deepens the notion of limited rationality put forward by Simon. Not only is it limited, but it is also ‘situated’: “Pure and universal rationality, without cognitive, affective, or structural limitations does not exist : it is always cultural, always contextual and contingent” (Friedberg, 1993, p. 212).

Depending on the particular information system one is attempting to design, the identification of actors is done in a contingent manner, through determination of the various parties who are to participate in the design of the system and its future use. We have therefore set up what we call a map of actors on the scene, which allows them to be identified, and allows the relationships which connect them to be indicated. These relations include power stakes, be these individual, task-oriented, group-oriented or collectively oriented (Friedberg, 1988) . We were particularly interested in exchanges of information between actors, since this is an essential and important power resource (Crozier and Friedberg, 1977). The nature of such information and the mode of exchanging it were noted in specific observations. It was important to identify in a preliminary way the characteristics of existing information systems, whatever their nature, because we were about to introduce a new system for the collection and diffusion of information.

Over and above the tasks carried out by the team within the analyzed unit, the perceptions that actors had of their unit and the goals and aims they associated with it were also determined. For this, we used analytic matrices proposed by the CSO⁷, including the following essential elements (Friedberg, 1988) :

- actors' perceptions of their roles, their resources, and their control over zones of uncertainty characteristic of their organization ;
- actors' perceptions of the information system being designed, and the things at stake in that process ;
- identification of strategies put into operation, as well as means and alliances which could assist those strategies.

This dimension of the analysis presupposes taking into account an actor, free to make choices as a function of his or her perceptions of change taking place and what was at stake for him or her in that process. In order to carry out choices, actors develop behavioral strategies which are appropriate, using the resources at their disposition in the manner which seems most appropriate to them, given the representations they may possess, of the contextual constraints in force at a given time. An actor's behavior in a situation in which a new information system is about to be introduced can never be predicted, because the

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situation is always quite fluid. The actor must constantly adjust to contextual constraints by which he or she believes himself or herself confronted, taking into account his or her objectives. In this sense, his or her behavior in the face of change is always rational but not absolutely so : he or she is looking for a satisfactory solution which will permit him or her to use in the most advantageous manner the means and resources which are available, circumstances being taken into account, in order to attain his or her own objectives. These may be quite varied in nature, and may be located within the organization, or not. The basic idea is that these objectives do not necessarily coincide with those of the organization such as these might be identified through a mechanical analysis such as was presented above. Collective action always depends on participation by members, and this participation is always negotiated through their leader, even implicitly. The terms of this kind of negotiation are exactly what we were trying to identify through taking into consideration the second dimension of our investigation's methods, in order to understand 'organizational tinkering' as it occurred in the units under analysis. The organizational phenomenon is thus grasped as a political body, no longer as a mechanical grouping of gears turned first by one and then by another, governed by a single rationality. This way of doing things allowed us to understand the elements of a political nature which constitute all information systems. This can only be accomplished through in depth interviewing of actors involved in the system being constructed.

The results of the political analysis of the second dimension of our model allowed us to narrow down the field of possibilities with regard to the system of information, yielding specifications which were certainly less optimal than those which would have been produced by the mechanical analysis, though more satisfying or practical in view of constructed equilibria which were in operation within the organizational unit under consideration.

While taking account of the mechanical and political dimensions of the organizational phenomenon, as this is linked to the development of a system of information, allowed us to identify mechanisms of differentiation and integration at work in the organizational units studied, as well as to identify actors who play a role in that unit's activities which is more or less important, just as the relations which interrelate them are more or less important - while, we say, this was possible for us, it remains in our view important as well to complete these parts of a whole by taking into account the types of justification (Boltanski and Thevenot,

1997) which are mobilized by actors on scene in order to legitimate their actions and their perceptions of the system of information which was being constructed. Basing ourselves on the typology of “the Economics of Worth”, we sought to identify, within the empirical contexts in which we were interested :

- the “common higher principle” held to by those at the scene, principles which could serve as a basis for constructing agreements with regard to the objectives of the unit being analyzed, certain purposes and other characteristics of the system being designed ;
- the “states of worth”⁸ which characterize that which is “the greater” or “the smaller” with regard to the higher principles which were identified. These permanent states allowed us to determine that which was legitimate within the organizational phenomenon, and that which was not;
- “orders of worth”⁹ which characterized the relations between that which was considered as “the greater” and that which was considered as “the smaller”, all of which were evaluated beginning with justifications put forward by persons regarding the nature of their relations, as well as the relations they might be likely to have with the computer-related object in the actual case;
- repertoires of objects (non-human) and subjects (humans) mobilized by actors in their discourses with regard to the computerization of their organizational entity.

We obtained the data related to these indicators from specific documents which are part of emergency service operations, detailing their missions and various strategies, and also from in depth interviews with the actors/personnel of the services, conducted in an appropriate manner. This stage of the analysis can also be assisted by discussion sessions with the actors so that changes which are acceptable can emerge from dialogue.

Our recourse to a symbolic level allows us to understand the norms and values which help regulate the behavior of emergency service professionals. It also allows us to test different possible ways of constructing the computer system and arranging it, these possibilities having different meanings and legitimacy for various actors. A process of clarifying the actors’ values and an attempt to shape a ‘meta-system’ of shared values are involved in the negotiation of acceptable or legitimate forms of change.

⁸ Translation of « les états de grandeur ».

⁹ Translation of « les rapports de grandeurs ».

V. Conclusion

As we conclude this presentation, we think it important to underline the cumulative nature of our investigations. While for pedagogical reasons we set forth the three dimensions or levels of our analysis in a fairly sequential manner, in practice these levels interacted, in a kind of dynamic reflexivity of the analysis, a complexity of interaction pushed to the point of saturation, in terms of knowledge as much as of the exploration of the many possibilities which exist regarding the specific character of information systems.

The analysis thus performed leads to our elaborating two relationships involving the whole group of actors in the project (research team and emergency response team). In one, we take account of our 'knowledge of the social' as this appears in the analysis through observation of systems of action, and the study of the representations of the people on the emergency response team. In the second, we set forth in the form of scenarios the various areas of possibilities as regards the arrangement of information systems, illuminating these through the various perspectives generated by analyses from a mechanical, political, or symbolic point of view.

Once again, in this brief conclusion, we would like to raise the question of the role of the human sciences in the conception of information systems. This returns us to the question of our confronting the analysis carried out by our research team with the analysis carried out by the other teams in the project, and with that offered by still other professionals of emergency response work.

The first confrontation occurs at one and the same time on all the levels of the analysis, technical, political, and symbolic. Technically, the analyses of existing structure and the scenarios put together by the team are in principle the 'inputs' for those who will later express their results in formal terms which can be used by programmers. This confrontation is more than technical, since it occurs and perhaps must occur in the intersecting relationship between human rationalities and types of legitimacy which may be difficult to reconcile. That which computer experts seek in our analyses, are stable systems which are the more durable in that their invariant structures have been discovered, structures which are independent of the shifting and contingent realities which we have described. This search for coherence and stability is justified by a sort of industrial legitimacy which makes the logic of programming the only principle of reality which their models must confront. As such, this confrontation is often quite frustrating for the human sciences, since the search for

coherence and stability comes at the price of impoverishing the meaning of the reality which we studied, and which has emerged from our research.

Is this as much as to say that it is useless to try to employ the human sciences in the conception and design of information systems ? One way of answering this question is to locate our conception of the role of the human sciences within the classification of four specific forms of intervention identified by Dortier (1999), that is, information, advice and expertise, social engineering, and militant engagement. As concerns our team, our position has always privileged the first role, that of information, and this position follows the theory of reflexivity put forward by Giddens : «The theory of reflexivity admits...that knowledge is a cause of change. Social actors acquire various types of knowledge and learn about models which have come out of the social sciences, and this in turn contributes to their modifying their behavior» (Dortier, 1999, p. 5) Such a process of reflexivity actually seems to be at work in the relationships which we maintain with emergency service professionals, in which the mirror effect of our analyses already brings questions, reflections, and evolutionary changes into contact with practices. But this process of reflexivity is also present in computer experts who play around with methods and techniques of model-building in a spirit of openness to other forms of rationality.

To conclude regarding change : it appears fairly clear to us at the completion of this project that change is to be located, undoubtedly, more within this dynamic of analysis and exchange which we share with the group of actors connected with the project than located in the information system which is the result of the project.

VI. References

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